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(54) Governor arrangement

(57) A governor arrangement for an internal combustion engine is disclosed which comprises a plurality of weights (1) rotatable with a rotatable drive shaft (2) and pivotable with respect to the shaft (2). The weights (1) are engageable with a washer (9) which, in turn, engages a sleeve (3). The sleeve (3) engages a lever the position of which is used to control the setting of a metering valve. A hydrodynamic bearing arrangement is provided between the sleeve (3) and washer (9). A drive arrangement may be provided to drive the washer (9) when the rotational speed of the shaft (2) is insufficient to cause the weights (1) to move the sleeve (3).

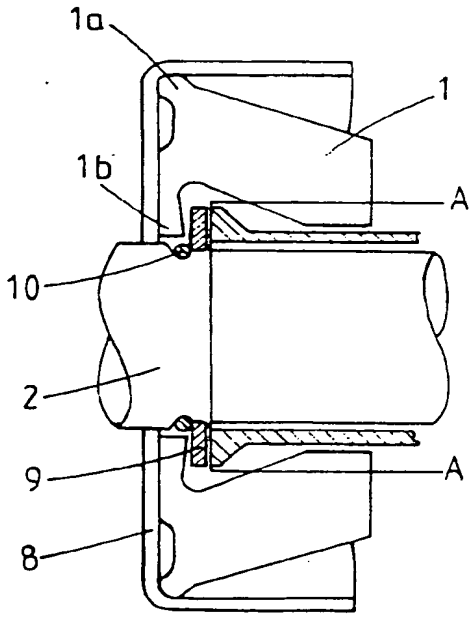

FIG.2.

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1 having a region 1a arranged to engage the cage 8 to permit the weights 1 to pivot with respect to the cage 8. The weights 1 are so arranged that they rotate with the cage 8. Each weight 1 further comprises a toe 1b which is engageable with a face of a thrust washer 9 which encircles the drive shaft 2.

The governor arrangement further comprises a thrust sleeve 3 which is moveable in the axial direction of the drive shaft 2, the thrust sleeve 3 encircling the drive shaft 2. As in the arrangement illustrated in Figure 1, the thrust sleeve 3 is arranged to engage a lever 4 which is biassed by means of a governor spring 5 in order to push the thrust sleeve 3 towards the left as illustrated in Figure 2. The engagement of the thrust sleeve 3 with the lever 4 further limits rotational movement of the thrust sleeve 3. As illustrated in Figure 2, the thrust washer 9 is interposed between the toes 1b of the weights 1 and a free end region of the thrust sleeve 3.

The drive shaft 2 is provided with an annular groove within which a rubber ring 10 is seated. The groove is positioned such that when the drive shaft 2 is stationary and the weights 1 occupy their inner most position due to the thrust sleeve 3 being urged towards its left most position by means of the spring 5, the thrust washer 9 is trapped between the ring 10 and the free end of the thrust sleeve 3. Upon rotation of the drive shaft 2, the washer 9 is caused to rotate with the drive shaft 2 due to the engagement between the washer 9 and the ring 10. As the speed of rotation of the drive shaft 2 is increased, a speed will be reached beyond which the weights 1 tend to pivot outwardly, the regions 1a thereof remaining in contact with the cage 8, such pivotal movement of the weights 1 bringing the toes 1b into contact with the washer 9, the engagement between the weights 1 and the washer 9 acting against the force pushing the washer 9 into engagement with the ring 10. It will be recognised that further movement of the weights 1 results in axial movement of the washer 9 to break the engagement between the washer 9 and the ring 10.

Figure 3 is a view of the end of the thrust sleeve 3, Figure 4 being a perspective view of part of the end of the thrust sleeve 3. As illustrated in Figures 3 and 4, the end of the thrust sleeve includes an annular raised surface 11, and radially inward of the surface 11, a plurality of ramped surfaces 12 are provided, each of the ramped surfaces 12 being spaced from the remaining surfaces 12 by respective grooves 13.

In use, the governor arrangement is provided within a housing containing relatively low pressure fuel. Upon rotation of the drive shaft 2, fuel which is located between the drive shaft 2 and the thrust sleeve 3 tends to move radially outward into the grooves 13 and on to the ramped surfaces 12. The rotation of the washer 9 with respect to the end of the thrust sleeve 3 tends to draw fuel from the grooves 13 up the ramped surfaces 12, and as the separation of the washer 9 from the ramped surfaces 12 is not uniform, decreasing in the direction of rotation of the washer 9 the pressure of the fuel increases. Such a pressure increase results in the washer 9 tending to be held away from the end of the thrust sleeve 3 by the fuel, thus forming a hydrodynamic bearing. At normal operating speed, such hydrodynamic lubrication between the washer 9 and the end of the thrust sleeve 3 tends to maintain rotation of the washer 9 with respect to the thrust sleeve 3.

It will be recognised that although the lubrication between the washer 9 and the thrust sleeve 3 is improved, friction is still present, and hence there are forces tending to reduce the speed of the washer 9, those forces being lower than the frictional forces between the toes of the weights 1 and the washer 9. Such frictional forces result in the washer 9 rotating at a speed slightly slower than the speed of rotation of the weights 1. The small amount of relative rotation between the washer 9 and the weights is advantageous in that wear occurring on the washer 9 is evenly distributed around the washer 9 rather than being restricted to relatively small areas. It has been found that there is a relative speed of approximately 1 revolution per minute.

The provision of the raised surface 11 surrounding the ramped surfaces 12 and grooves 13 protects the ramped surfaces 12 from wear, and additionally limits radial leakage of fuel from the grooves 13 and ramped surfaces 12 thus improving the efficiency of the hydrodynamic lubrication. It will, however, be understood that the raised surface 11 is not essential.

In use of the governor arrangement, variations in engine speed resulting in variations in the speed of rotation of the drive shaft 2 cause the weights 1 to adopt different pivotal positions with respect to the drive shaft 2, hence causing the thrust sleeve 3 to adopt a different axial position. Such movement of the thrust sleeve 3 is transmitted to the metering valve 6 through the lever 4 and suitable coupling arrangement 7, for example as in the arrangement illustrated in Figure 1. It will be understood that the operation of the governor arrangement is dependent upon the level of stressing of the governor spring 5, and as shown in the conventional arrangement illustrated in Figure 1, a manually operable lever 14 may be provided in order to control the level of stressing of the governor spring 5.

Claims

1. A governor arrangement comprising a plurality of weights (1) pivotable with respect to and rotatable with a rotatable shaft (2), the weights (1) being arranged to engage a washer (9) which is interposed between the weights (1) and a thrust sleeve (3) such that pivotal movement of the weights (1) results in axial movement of the washer (9) and the thrust sleeve (3), and characterized by bearing means to promote rotary motion between the wash r (9) and the thrust sleeve (3).

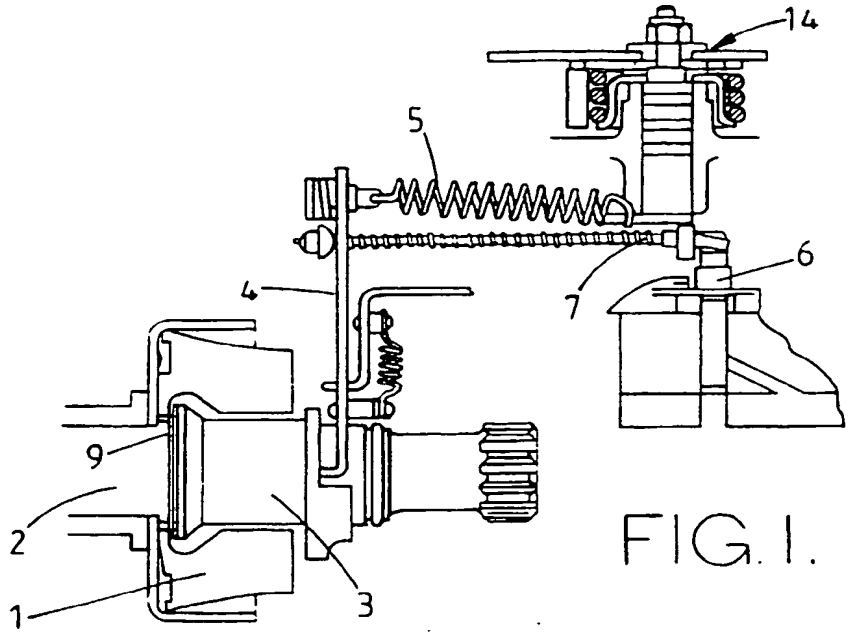

FIG.1.

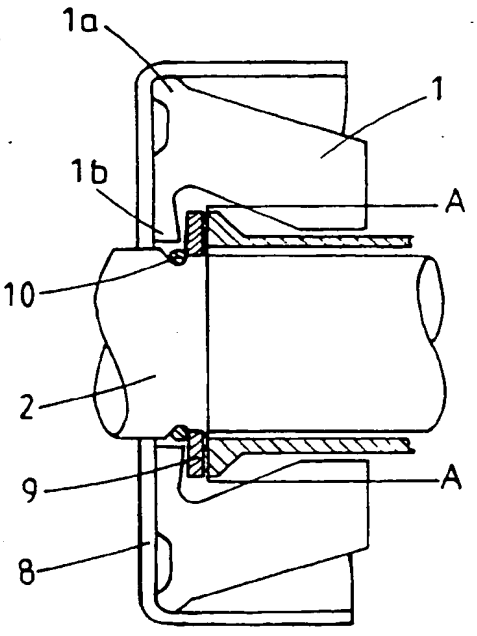

FIG.2.

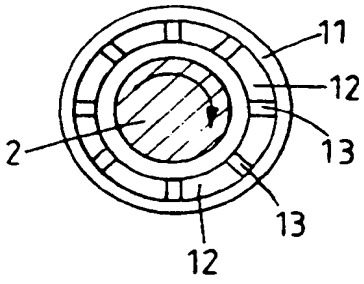

FIG.3.

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 96 30 6193

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	US-A-3 199 499 (KLEEBERGER) 10 August 1965 * column 3, line 9-15; figure 1 *	1,6	F02D1/04

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

F02D
G05D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	31 October 1996	Torle, E

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological background
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E : earlier patent document, but published on, or after the filing date
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